An Interdisciplinary Approach to Improving Central Lab Turnaround Time for Stat Troponin Testing

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Abstract

- **Context**: Rapid recognition of myocardial infarction is associated with improved outcomes. Guidelines for troponin testing have recommended troponin result availability within 60 minutes of physician order
- **Objective**: Evaluate efficacy of process improvement on rapid availability of troponin to make results consistently available within 60 minutes
- **Methods**:

  Design – Prospective monitoring of times from arrival in the emergency room to physician order, sample collection, laboratory delivery, and result availability in 1,757 consecutive patients seen after process improvement, compared to 300 consecutive patients seen before intervention

  Setting – Emergency room of an urban, Veterans Affairs medical center, with central laboratory testing (using the Beckman-Coulter Access 2 analyzer), and no automated system for laboratory sample delivery

  Participants – Consecutive patients with suspected acute myocardial infarction seen over 9 months

  Intervention – Process improvement team altered procedures for sample transport and laboratory processing based on analysis of baseline performance.

Main outcome measures – Time from order to lab arrival and result completion, percent of troponin results completed within specified times (45, 60 minutes)

- **Results**: At baseline, the median total time from physician order to test completion and reporting was 91 minutes. Median time from order to laboratory arrival decreased from 45 to 12 minutes, and median laboratory processing time decreased from 45 to 24 minutes. Median time from order to completion decreased from 91 to 37 minutes; 90% of tests were completed within 1 hour of order (compared to 15% at baseline), and 75% were completed within 45 minutes (compared to 3% at baseline)
- **Conclusions**: Even with central laboratory testing, improvements in process can produce acceptable turnaround time for troponin measurement, similar to those achieved with point of care testing.

Troponin Performance

- Practice guidelines (ACC, NACB) recommend that results for troponin be available within 60 minutes (of sample collection or physician order)
- Data suggest that this is a problem for most laboratories that do central lab testing
- CAP Q-probe published in 2004 (Arch Pathol Lab Med 128:154)

CAP Q-probe

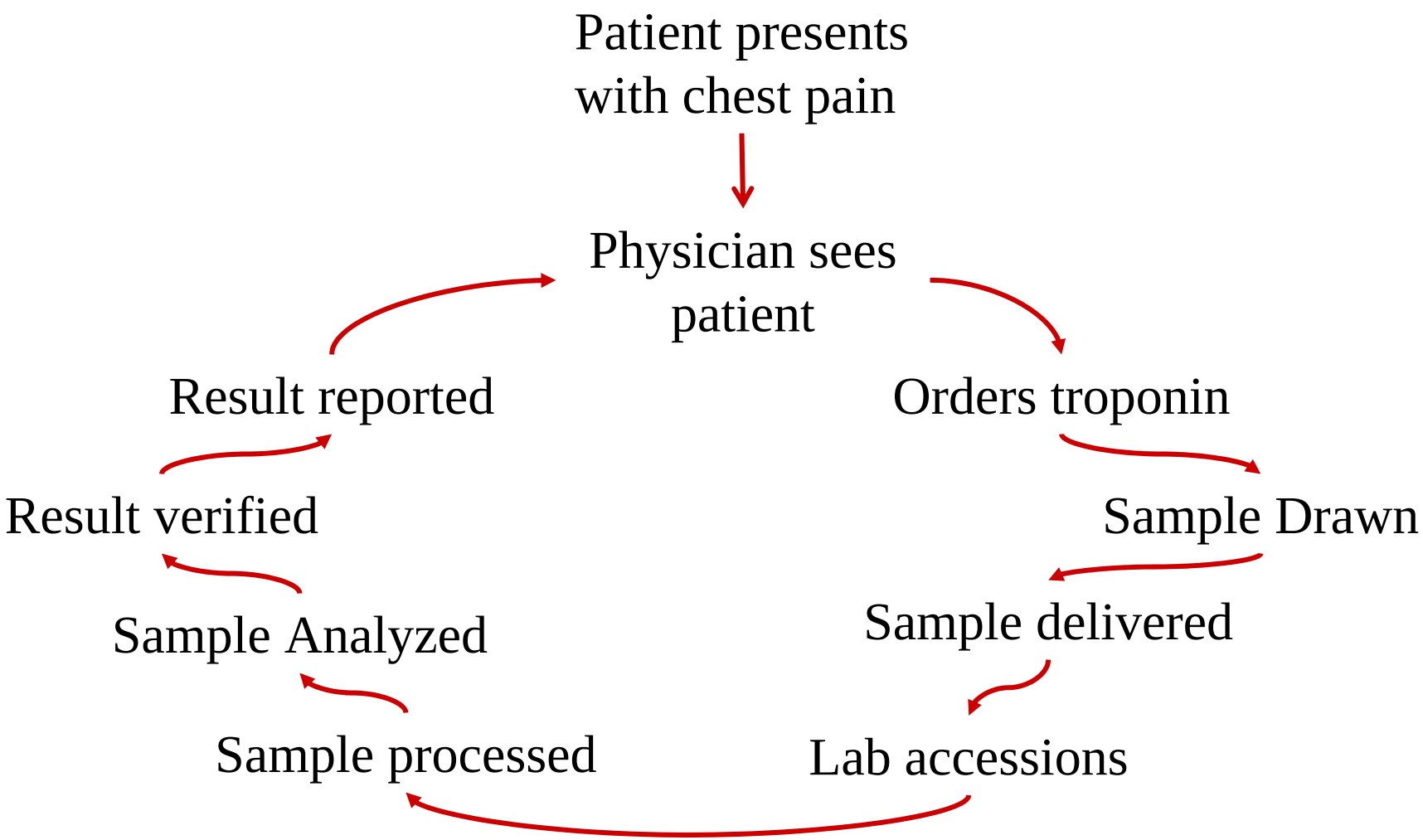
- Data from 159 hospitals
- Median time from order to report 58 minutes (order to receipt 15 minutes, laboratory processing 39 minutes)
- In top 10% of labs, median time 45 minutes, and 90% completed in 66.5 minutes
- Better performance related to point of care testing, lab staff drawing blood

- Point of care analysis involves fewer steps, so it should always be faster – this is usually the case in most settings
- Other issues may be important in some settings:
  - Cost of POC testing usually higher
  - Precision may not be as high as central lab
  - Results may not be comparable if different assays used in central laboratory
  - Requires a “champion” at local site

SETTING

- Large (1.8 million test) central laboratory with no pneumatic tube system; ER on 1st floor, lab in basement, one wing over
- Nurses draw blood in ED, couriers deliver blood to lab
- Troponin run on Access 2 assay; have both LXi and freestanding versions

CENTRAL LAB TEST CYCLE



Time for performing various tasks, baseline

	Percentile Distribution (minutes)				
Parameter (time)	10th	25th	50th	75th	90th
Patient arrival to order	10	17	30	64	155
Order to draw	-51	-15	-2	12	36
Order to lab arrival	17	27	45	69	158
Lab arrival to completion	29	35	45	70	105
Patient arrival to completion	76	100	132	178	248
Order to completion	56	68	91	119	156

CAUSES OF DELAYS

- Non-standardized approach
- Couriers not readily available to transport samples to lab
- Delays in recognition of stat troponin in lab
- Batching of sample handling
- Delays for centrifugation, sample aspiration
- Lack of awareness by technologist when tests complete and results available

PROCESS IMPROVEMENT

- Commitment by both Chief of Nursing and Laboratory to improve process; set target of 15 minutes for delivery to laboratory, 35 minutes in lab time
- Data collected for each patient in real time, daily review by all parties involved, decreasing frequency as needed

Changes in Documentation and Procedure

- Collection time entered in nurses' notes
- All specimens ordered "stat"
- Only heparinized plasma tubes allowed for troponin samples

Changes in Emergency Room Handling

- Creation of log book for troponin sample tracking
- Immediate call to escort service when sample collected
- Separate bag for troponin sample
- Sample hand-delivered to laboratory
- Sample handed directly to a medical technologist
- Delivery acknowledged by technologist initials in log book
- Time of delivery documented by time stamp in log book

Changes in laboratory handling

- Immediate accessioning of sample into computer system
- Separate centrifuge reserved for troponin samples to allow immediate handling
- Dedicated analyzer reserved for troponin measurement (backup instrument)
- Use of manual timer with alarm to remind technologist to review results
- Prioritized review of troponin results and verification in computer
- Medical alert notification of physician for all positive troponin results

Time for various tasks, post-intervention

	Percentile Distribution (minutes)				
Parameter (time)	10th	25th	50th	75th	90th
Patient arrival to order	10	18	32	55	114
Order to draw	-4	0	3	9	17
Order to lab arrival	5	7	12	20	32
Lab arrival to completion	21	22	24	27	32
Patient arrival to completion	47	56	72	98	164
Order to completion	29	32	37	46	60

RESULTS

- Rechecked at 2 months after daily checks stopped; performance maintained
- Causes of outliers (n = 162) mostly preanalytic
  - Delay in transportation to lab – 78 (48%)
  - Delay in phlebotomy – 40 (25%)
  - Technologist error – 16 (10%)
  - Poor veins requiring repeat phlebotomy – 15 (9%)
  - Analyzer problem – 9 (6%)
  - Combination laboratory/transport problem – 4 (2%)

LESSONS LEARNED

- Process complicated, but can be improved
- Requires commitment from senior leadership, monitoring, feedback
- Recording of draw times most difficult to accomplish; often differed between notes, label on tubes
- Significant delays exist from patient arrival to order not addressed in study